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ABSTRACT

A 3-year study was conducted to document individual differences in computer interest and use among middle school students and the psychological and social processes that may contribute to these differences. A questionnaire was used to assess the computer interest and use of a sample of approximately 400 middle school students at the end of each of the 3 years. The dependent measures--interest in learning about computers, plans to take elective computer classes, willingness to consider a computer career, and non-school computer use--and outcome measures were combined into a computer interest and use composite score. Eight independent variables were selected: mathematics interest, current goals for computer use, mathematics achievement, perceived parental encouragement for computing activities, perceived peer reactions to computer involvement, perceived relevance of computing skills for the future, perceived self-efficacy for computer-related tasks, and affective responses to the computer. These variables were organized using a newly developed version of "living systems" theory and students were asked to rate them on a scale of 1 to 5. Regression analysis of the data from the questionnaires and additional demographic and descriptive data showed that: (1) the gender of the subject appears to be an important social characteristic to consider in predicting computer interest and use since there were significant differences in favor of males; (2) boys may be more involved in computers as the result of more opportunities for mastery, more role models to emulate, greater verbal encouragement, and less fear of the machines; and (3) boys express a more positive attitude about the benefits of computers to society than do girls. Although there was a decline within grade levels from year to year over the 3-year period the variables showed consistent gender differences in favor of males. (DJR)

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Understanding gender differences in middle school computer interest and use

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Background

The educational use of microcomputers is rapidly expanding (Center for Social Organization of Schools, 1983): as a tool to teach other subjects, for specialized tasks (e.g., spread sheet analysis and word processing), and to develop problem-solving skills through the teaching of programming languages. As more schools introduce computers into classrooms, it is becoming increasingly evident that boys have greater interest than girls in learning to use them (Hess & Miura, 1984; Lockheed, Nielsen, & Stone, 1983; Sheingold, Kane, & Enderweit, 1983).

What are the psychological and social processes that contribute to gender differences in computer interest and use? Does home-computer ownership affect these processes? The results reported here are part of a three-year longitudinal study designed to document individual differences in computer interest and use among middle school students and to attempt to increase our knowledge of the psychological and social processes that may contribute to these differences. An understanding of such processes is a prerequisite for the development of effective educational strategies to maximize the potential benefits of this new information technology.

Method

A questionnaire was used to assess computer interest and use, and the processes predicted to affect these outcomes. In addition, other demographic and descriptive data, such as home-computer ownership, primary use of the home-computer, and extracurricular computer classes were included. The sample for the study was the entire student population (approximately 400 students each year) of a middle school (grades six through eight) located in a suburban community in California. The students were surveyed at the end of the school term for three consecutive years.

The dependent measures were interest in learning about computers, plans to take elective computer programming classes in high school, willingness to consider a computer-related career, and nonschool use of the computer. The outcome measures were also combined into a computer interest and use composite score, and the results for this combined measure are reported here.

Eight predictor variables, identified through pilot work and from a review of the literature on computer literacy and mathematics achievement, were selected and organized using a newly developed version of "living systems" theory (D. Ford, 1984; M. Ford, 1984). These variables were: mathematics interest, current goals for computer use, mathematics achievement, perceived parental encouragement for computing activities, perceived peer reactions to computer involvement, perceived relevance

of computing skills for the future, perceived self-efficacy for computer-related tasks. and affective responses to the computer.

Students were asked to rate their opinions on these topics using a scale of 1 to 5 (1=definitely not; 2=doubtful; 3=maybe; 4=probably; 5=definitely). The self-efficacy portion of the questionnaire was designed following Bandura's procedures; 10=not very confident at all, to 100=completely confident.

Results

Regression analyses showed that all of the independent variables, including gender, computer ownership, and grade in school, accounted for 68 percent of the variance in Year 1, 71 percent in Year 2, and 69 percent in Year 3. With gender, grade, and ownership removed, the remaining psycho-social process variables continued to account for a substantial portion of the variability in the composite score. Analysis of Year 1 data showed that the psychological and social process variables accountedfor 59 percent of the variance in the computer composite score. Affective responses to the computer, perceived self-efficacy (both $p < .001$), current goals for computer use, perceived parental encouragement, perceived peer reactions to computer involvement, mathematics interest, and perceived relevant of computing skills for the future all made a significant contribution to the regression equation ($p < .05$). Data from Year 2 showed that the variables accounted for 64 percent of the variance. Affective responses to the computer, perceived self-efficacy (both $p < .001$), and perceived peer reactions ($p < .01$) were significant predictors for the group as a whole. In Year 3, the predictor variables accounted for 64 percent of the variability in the composite score. Affective responses, perceived self-efficacy, perceived peer reactions (all $p < .001$), mathematics achievement ($p < .05$) and math interest ($p < .10$) were significant contributors to computer interest and use.

Gender of the subject appeared to be an important social characteristic to consider in predicting computer interest and use. When grouped by gender, there were significant differences in favor of males on all of the dependent variables ($p < .01$) in all three years. Reliable gender differences were also found In Year 1 for all of the independent measures ($p < .05$) except perceived parental encouragement where there was no difference. In Years 2 and 3, gender differences were found for all independent measures except perceived parental encouragement, mathematics interest, and perceived relevance of computing skills for the future.

Males were more likely than females to have access to a home-computer. In Year 1, 39 percent of the student population reported having access to a home-computer; 44 percent of the boys and 38 percent of the girls (marginally significant at $p = .08$). In Year 2, the percentage of student computer owners rose to 53 percent; 65 percent of the males compared to only 44 percent of the femalees. By Year 3, the percentage of owners was 65 percent; 74 percent of the boys and 56 percent of girls reported that their families owned at least one microcomputer.

These differences in computer ownership by gender are highly significant ($p < .001$). Overall, boys reported significantly more time using the home-computer than did girls. Boys were also more likely to have taken an extracurricular computer class. For both boys and girls, games were the primary activity reported; 50 percent of the boys in Years 1 and 2, and 70 percent in Year 3. The percentage of girls reporting games as the primary activity remained fairly constant at 76 percent in Year 1, 70 percent in Year 2, and 63 percent in Year 3. Programming was also an important activity for boys. Thirty-two percent of boys in Year1reported programming as the primary activity. The figures dropped to 27 percent in Year 2 and to 9 percent in Year 3. For girls, programming was listed first by 14 percent in Year 1, 9 percent in Year 2 and 5 percent in Year 3. Word processing showed an upward trend for both boys and girls. Six and 7 percent of boys in Years 1 and 2 reported word processes as the primary activity. This doubled to 14 percent in Year 3. For girls, word processing increased from 1 percent in Year 1 to 16 percent in Year 2 and 21 percent in Year 3.

When computer owners and non-owners were compared, computer owners rated themselves more positively for all of the dependent measures. They also rated themselves higher than non-owners for perceived parental encouragement, affective responses to the computer, perceived relevance of computing skills for the future, current goals for computer use, and perceived self-efficacy. Differences between the two groups continued in Years 2 and 3. In the final year, computer owners rated themselves higher than non-owners for interest in learning about computers, nonschool computer use, mathematics achievement, perceived parental encouragement, affective responses, perceived peer reactions, and perceived self-efficacy.

There were, however, gender differences among computer owners. Males rated themselves more positively than females for the outcome measures and for affective responses to the computer, perceived peer reactions to computer involvement, and perceived self-efficacy for computer-related tasks (all $p < .01$), and for current goals for computer use ($p < .01$).

Gender differences in computer interest and use were also mediated by age. Males showed fewer differences than females who seemed to show a fairly steep decline even within this relatively narrow age range. Analyses of the three-year trend showed that there was a general decrease in the ratings for all variables from sixth grade to eighth grade with the exception of perceived self-efficacy which rose significantly for this group (Table 1). Additionally, classes also varied in the same pattern across time. There was a decline from year to year within grade levels (Table 2).

Discussion

Over the three-year period, reliable predictors of computer interest and use were perceived self-efficacy for computer-related tasks, affective responses to the computer, and perceived peer reactions to computer involvement, and these variables showed consistent gender differences in favor of males. According to Bandura (1977a, 1977b),

factors that affect perceived self-efficacy (an assessment of one's ability to complete a particular task) include performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal. In the area of computer involvement, boys may have more opportunities for mastery, more role models to emulate, greater verbal encouragement, and less fear of the machines (Hess & Miura, 1984). They express a more positive attitude about the benefits of computers to society than do girls (Dachey, 1983). If we accept Bandura's premise that perceived self-efficacy can affect the choice to engage in a task, the effort that will be expended to perform it, and the persistence that will be shown to accomplish it, then it is reasonable to expect that boys will show greater interest in using computers. Intervention strategies will necessarily have to focus on raising computer self-efficacy percepts and positive affective responses to the computer. If more girls can be encouraged to become computer users, then perceptions of peer reactions to computer involvement should also be more positive.

Computer ownership was also found to affect these factors positively. Computer owners expressed greater interest in learning about computers and, of course, reported more nonschool use than non-owners. However, the effects of computer ownership also appeared to be mediated by gender and may be a function of the differences in computing activities and time spent using the machine.

The decline within grade levels from year to year suggests that the changes from grade six to grade eight may not be simply the result of maturation or experience of individual students, but rather a more general change in attitudes toward computers. Students appeared to be less interested in computers, were less positive about considering a computer-related career, and less certain about taking a computer science class in high school. With the exception of perceived self-efficacy which appeared to increase with experience, the other independent variables remained the same or decreased. Perceived parental encouragement for computing activities, affective responses to the computer, and perceived peer reactions to computer involvement were especially notable in their decline across time. Possible explanations come to mind. First, more of these students have access to a home-microcomputer. They know first-hand what computers can do and what it is like to work with them. This takes away the mystique of the computer. In fact, the trend in reported use was toward game playing and word processing. The computer may be seen as just another machine to be added to the VCR, TV, and typewriter. Second, the decline in perceived parental encouragement and perceived peer reactions may reflect a general waning of enthusiasm among adults and young people for computers. Finally, in Year 1, the computer elective program at this middle school was still relatively new and restricted to the seventh grade. The majority of students and parents had not yet purchased their first micro. By the third year, microcomputers were being used in subject areas. In the current year, a computer applications elective is being offered, and it will be interesting to see if student computer interest continues to move inversely to the degree of integration of computers into the school curricula.

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Table 1

Mean differences in the composite score and the independent measures for students who were sixth graders in Year 1, seventh graders in Year 2, and eighth graders in Year 3

Variable	Year 1 Grade 6 (N=157)	Year 2 Grade 7 (N=159)	Year 3 Grade 8 (N=176)	p
Computer composite	3.12	2.90	2.56	<.001
Math interest	3.03	2.78	2.75	<.05
Math achievement	3.80	3.91	3.89	n.s.
Parental encouragement	3.66	3.70	3.47	<.10
Affective responses	3.78	3.52	3.30	<.001
Future relevance	4.01	4.10	3.93	n.s.
Current computer goals	4.05	4.07	3.78	<.001
Peer reactions	3.55	3.49	3.25	<.001
Self-efficacy	46.43	59.20	61.17	<.001

Table 2

Comparisons of mean differences in the composite score and the independent measures for students grouped by grade across the three years

Variables	Grade 6 Year 1 (N=157)	Year 2 (N=107)	Year 3 (N=108)	p
Computer composite	3.12	2.82	2.67	<.001
Math interest	3.03	2.82	2.96	n.s.
Math achievement	3.80	3.81	3.88	n.s.
Parental encouragement	3.66	3.62	3.12	<.001
Affective responses	3.78	3.54	3.41	<.001
Future relevance	4.01	4.11	3.62	<.001
Current computer goals	4.05	4.08	3.83	<.01
Peer reactions	3.55	3.45	3.18	<.001
Self-efficacy	46.43	42.77	54.95	<.01

Variables	Grade 7 Year 1 (N=136)	Year 2 (N=159)	Year 3 (N=153)	p
Computer composite	2.97	2.90	2.49	<.001
Math interest	2.89	2.78	2.36	<.001
Math achievement	3.81	3.91	3.80	n.s.
Parental encouragement	3.91	3.70	3.39	<.001
Affective responses	3.61	3.52	3.29	<.01
Future relevance	3.98	4.10	3.83	<.05
Current computer goals	4.14	4.07	3.99	n.s.
Peer reactions	3.56	3.49	3.18	<.001
Self-efficacy	56.71	59.20	55.86	n.s.

Variables	Grade 8 Year 1 (N=140)	Year 2 (N=128)	Year 3 (N=176)	p
Computer composite	2.82	2.63	2.56	<.05
Math interest	2.93	2.65	2.75	<.10
Math achievement	3.86	3.73	3.89	n.s.
Parental encouragement	3.74	3.63	3.47	<.05
Affective responses	3.66	3.37	3.30	<.001
Future relevance	4.02	3.89	3.93	n.s.
Current computer goals	4.14	3.86	3.78	<.001
Peer reactions	3.56	3.27	3.25	<.001
Self-efficacy	54.57	52.04	61.17	<.05